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PENNSYLVANIA GEOLOGICAL SURVEY
FOURTH SERIES

PRELIMINARY REPORT

OCCURRENCE OF ROCK SALT IN PENNSYLVANIA

By

CHAS. R. FETTKE

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF INTERNAL AFFAIRS
GENEVIEVE BLATT, *Secretary*

TOPOGRAPHIC AND GEOLOGIC SURVEY
CARLYLE GRAY, *Acting Director*

1955

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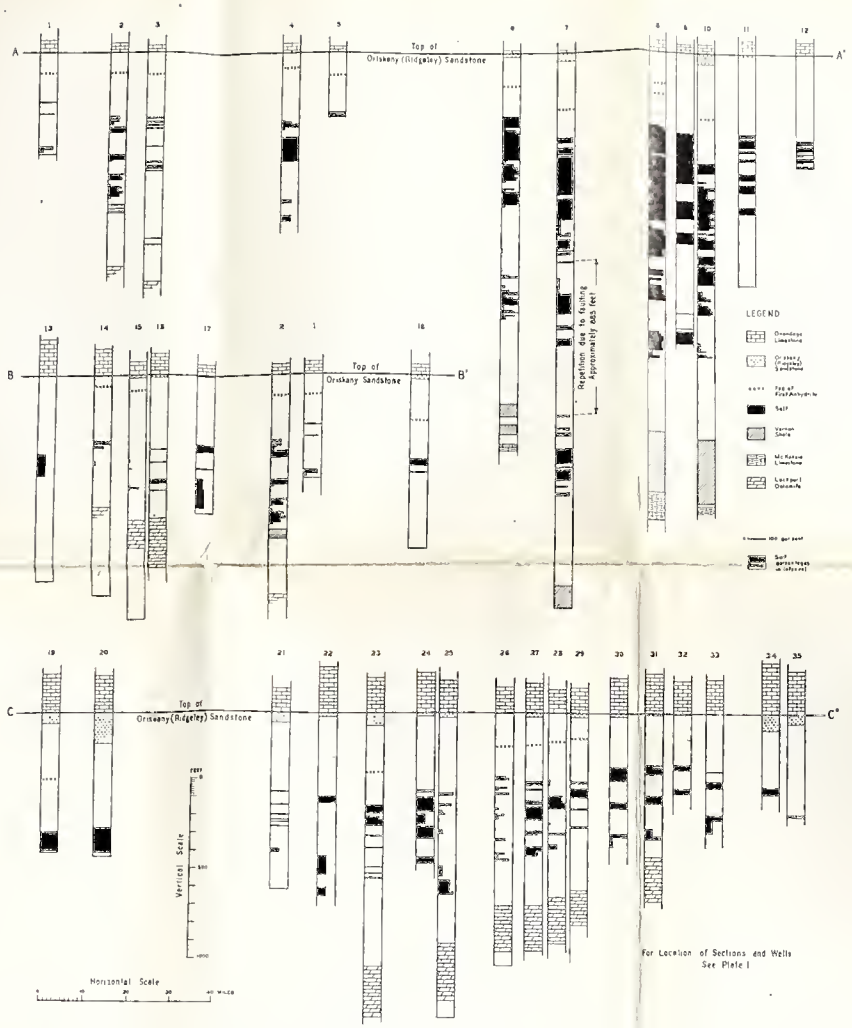

For Location of Sections and Wells See Plate I

COLUMNAR SECTIONS SHOWING STRATIGRAPHIC POSITION AND THICKNESS OF SALT BEDS IN NORTH-CENTRAL AND WESTERN PENNSYLVANIA

FIGURE 1

CHAS. R FETTKE 1955

LIST OF WELLS

FROM WHICH DATA FOR PLATE 1 WERE OBTAINED

No.	Name of well	Operator	County	Reference to Well Record
1	Tyrrell and Wilcox #8	W. G. Downey	Jefferson	Bull. M 31, Harrisville 1
2	Pennsylvania State Game Lands, Warrant 3603, #1	Pennsylvania Gas Co.	Elk	Bull. M 31, Hallton 1
*3	Morrant 3788	United Natural Gas Co.	Elk	*Bull. M 31, Kane 3
4	Crawford Estate #1	Potter Development Co.	Potter	Bull. M 31, Keystone 3
5	Arthur B. Watson #1	Potter Development Co.	Potter	Bull. M 31, Coudersport 57
6	Roy Herrington #1	New Penn Development Corp.	Steuben	New York
7	Lyle E. Shoemaker #1	Ironsides Natural Gas Corp.	Tioga	*Bull. M 31, Tioga 3
8	Federal Land Bank #1	Belmont Continuous Drilling Corp & New Penn Development Corp.	Schuyler	New York
9	William Hager et al, #1	Benedict Trees	Schuyler	New York
10	R. C. Easterling #1	N. Y. State Nat. Gas Corp.	Chemung	New York
11	Ithaca salt well		Tompkins	New York
12	Phillip G. Overbaugh #1	Suburban Propane Gas Corp.	Portland	New York
13	Dean Miller #1	Pennsylvania Gas Co.	Erie	Bull. PR 144, Erie 179
14	Speis #1	Potter Development Co.	Warren	*Bull. M 31, Youngsville 2
15	Reeves #1	Northern Petroleum, Inc.	Warren	Bull. M 31, Titusville 1
16	Ulf #1	Fidelity Petroleum Co.	Warren	Bull. M 31, Titusville 1
17	Cook #1A	Collins and Richard	Forest	Bull. M 31, Sheffield 3
18	W.M.Irwin Co's Tract #1	F. G. Downey	Jefferson	Bull. M 31, Pennsylvania 1
19	DeFreese Plant Corp. #1	Pittsburgh Plate Glass Co.	Marshall	West Virginia
20	Solvay Process #3	Allied Chemical & Dye Corp.	Marshall	West Virginia
21	R. A. Casey #1	The Peoples Nat. Gas Co.	Washington	Bull. M 31, Burgettstown 2
22	Burton Casselman #1	Pennsylvania Gas Co.	Columbiana	Ohio
23	James L. Jenals Estate #1	J.M.Hoff & J.T.Caley	Beaver	Bull. M 31, New Castle 8
24	Jenamieth #1	East Ohio Gas Co.	Mahoning	Ohio
25	F. W. and C.E. Hill #1	The Phillips Gas & Oil Co.	Lawrence	Bull. M 31, New Castle 7
26	S. M. Collins #12	E. A. Brown Co.	Mercer	Bull. M 31, Mercer 1
27	A. B. McCullough #1	Carnegie Nat. Gas Co.	Mercer	Bull. M 31, Stoneboro 3
28	Pearle Spellman #1	United Natural Gas Co.	Mercer	Bull. M 31, Stoneboro 3
29	J. Paul Miller #1	Mercer Oil & Gas Co.	Mercer	Bull. M 31, Stoneboro 1
30	Ellen Calvin #1	The Sylvania Corp.	Crawford	Bull. M 31, Linesville 7
31	James Taylor Lands #1	United Natural Gas Co.	Crawford	Bull. M 31, Linesville 2
32	W. D. Dahl #1	Potter Development Co.	Crawford	Bull. M 31, Meadville 1
33	J. Chapin #1	Potter Development Co.	Crawford	Bull. M 31, Union City 1
34	J. Kirk #1	Pennsylvania Gas Co.	Erie	Bull. M 31, Cambridge Spr.1
35	Chester Fuhrman #1	Appalachian Develop.Corp.	Erie	Bull. M 31, Erie 7
36	A. B. Bennett #1	The California Co.	Sullivan	Bull. PR 139, #83
37	Cormas #1	Miller, et al.	Clinton	
38	Jesse R. Miller #1	Appalachian Basin Assoc.	Bedford	Bull. PR 143, #2
39	W.R.Marine Est. #5	Manufacturers Light & Heat Co.	Fayette	Bull. M 31, Uniontown #31
40	L. F. Rayne #1	New Penn Develop., et al.	Fayette	Bull. M 31, Uniontown 6
41	J. S. Walker	J.C.Walker, et al.	Butler	Drilling 4-55
42	James C. Hockenberry #1	Manufacturers L. & H. Co.	Butler	*Bull. M 31, Mercer 2
43	Allen Irvin #10	F. G. Downey	Clearfield	Bull. M 31, Pennsylvania 2
44	Earl R. Minute #1	United Natural Gas	Mercer	Bull. M 31, Stoneboro
45	Chas. Cromarti #1	Sharon Steel Corp.	Mercer	Bull. PR 143, 129
46	Neffs #1	L. Rood	Mercer	Bull. PR 143, 133
47	Harm. L. Smith #1	Hillman & Hart	Mercer	Bull. M 31, Stoneboro 2
48	Gertrude Scott #1	Carnegie Nat. Gas	Crawford	Bull. M 31, Linesville 4
49	R. C. Jackson #1	Anthony J. Wise	Crawford	Bull. M 31, Linesville 5
50	Milan Calvin #1	Sylvania Corp.	Crawford	Bull. M 31, Linesville 7
51	Hickstown #1	Russell McConnell et al.	Crawford	Bull. PR 143, 123
52	Hadie Asper #1	J. W. Whitney	Crawford	Bull. M 31, Linesville 3
53	Good,Welch, & Russell #1	Russell McConnell et al.	Crawford	Bull. PR 143, 122
54	G. J. Russell#1	Russell McConnell et al.	Crawford	Bull. PR 139, 71
55	Frank A. Norris #1	Eugene Coats et al.	Crawford	Bull. M 31, Girard 13
56	Jay Chills #1	Ohio Oil Co.	Erie	*Bull. M 31, Girard 1
57	W. Hilliesteifer #22	Ohio Oil Co.	Erie	*Bull. M 31, Girard 2
58	Francis Miles #2	Rutherford Gas & Fuel	Erie	*Bull. M 31, Fairview 1
59	Wm. C. Ritner #1	Dougherty Bros.	Erie	Bull. M 31, Girard 5
60	ee, Steelman #1	Pennsylvania Gas Co.	Erie	Bull. M 31, Cambridge Spr.3
61	Frank Stutzman #1	Beaver Gas Co. Parcel, Co.	Erie	Bull. PR 144, Erie 177
62	L. L. Anderson #1	Star Oil	Warren	Bull. M 31, Irvingville 3
63	Chas. Carlson #1	C. R. Telegraff #1	Warren	*Bull. M 31, Warren 1
64	Dusenberry #1	Estes & Harris	Warren	Bull. M 31, Sheffield 1
65	Fels #1	Bradford Deep well	McKean	Bull. M 31, Bradford 1
66	L. D. Wilson #18	South Penn Oil	McKean	*Bull. M 31, Bradford 2
67	Chas. Rauh et al, #1	Allegany Gas Co.	McKean	Bull. M 31, Smethport 3
68	M. Earle Deep well	Potts- Development	McKean	Bull. M 31, Smethport 4
69	T. Hintage #1	Pennsylvania Gas Co.	Erie	Bull. M 31, Erie 13

Wells in New York, West Virginia, and Ohio not on lines of section, not listed.

*Complete well sample study record published.

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PRELIMINARY REPORT

OCCURRENCE OF ROCK SALT IN PENNSYLVANIA

by

Chas. R. Fettke

Although no salt has been obtained in the past or is being obtained from salt beds in Pennsylvania at present, exploration for deep oil and gas in recent years has revealed that almost the entire plateau area of north-central and western Pennsylvania is underlain by beds of rock salt. The salt occurs in the Salina group of the Cayugan Series. Individual salt layers range from less than five feet to nearly 200 feet in thickness. Salt beds sometimes possess combined thicknesses of over 650 feet and occupy intervals in the Salina group ranging from less than 50 feet to over 1200 feet. The uppermost salt bed is encountered at a depth of about 1500 feet below sea-level in the northwestern part of the State (Erie County) and between 8,000 and 8,500 feet below sea-level in the synclinal areas of the Allegheny Mountain belt in Fayette, Somerset, Westmoreland, Cambria, and Clinton counties northwest of the Allegheny Front.

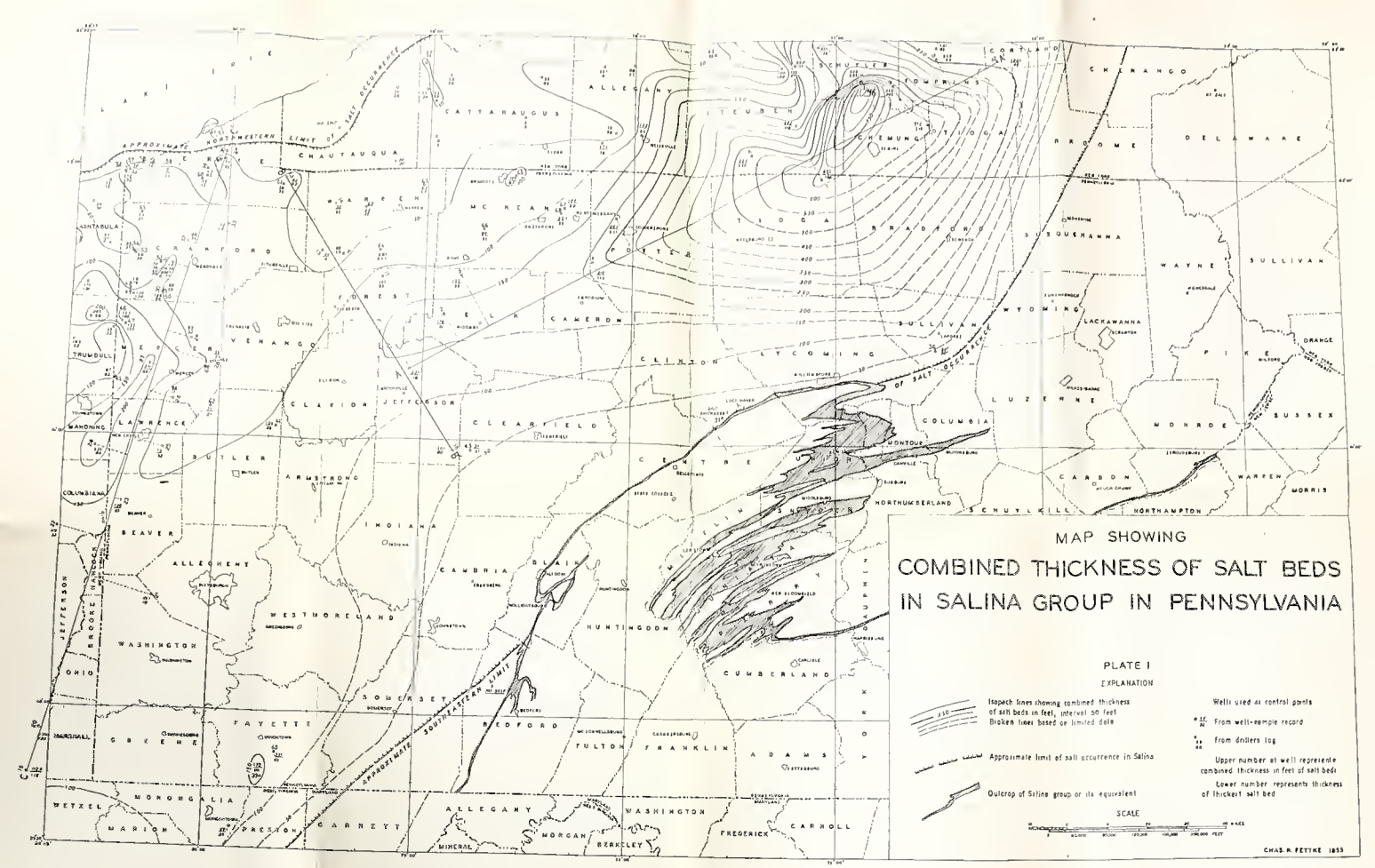
The area underlain by beds of rock salt is outlined with a heavy dashed line on the map of Plate 1. The stratigraphic positions and thicknesses of some of the salt beds are shown graphically in Figure 1. The combined thickness of the salt beds is shown by means of equal-thickness lines in Plate 1. The data for the thicknesses were obtained by the examination of drill-cutting samples and from information recorded in drillers' logs. Allowance was made for the presence of shale, argillaceous dolomite and limestone, and anhydrite partings in the salt beds in estimating the thickness of the individual beds.

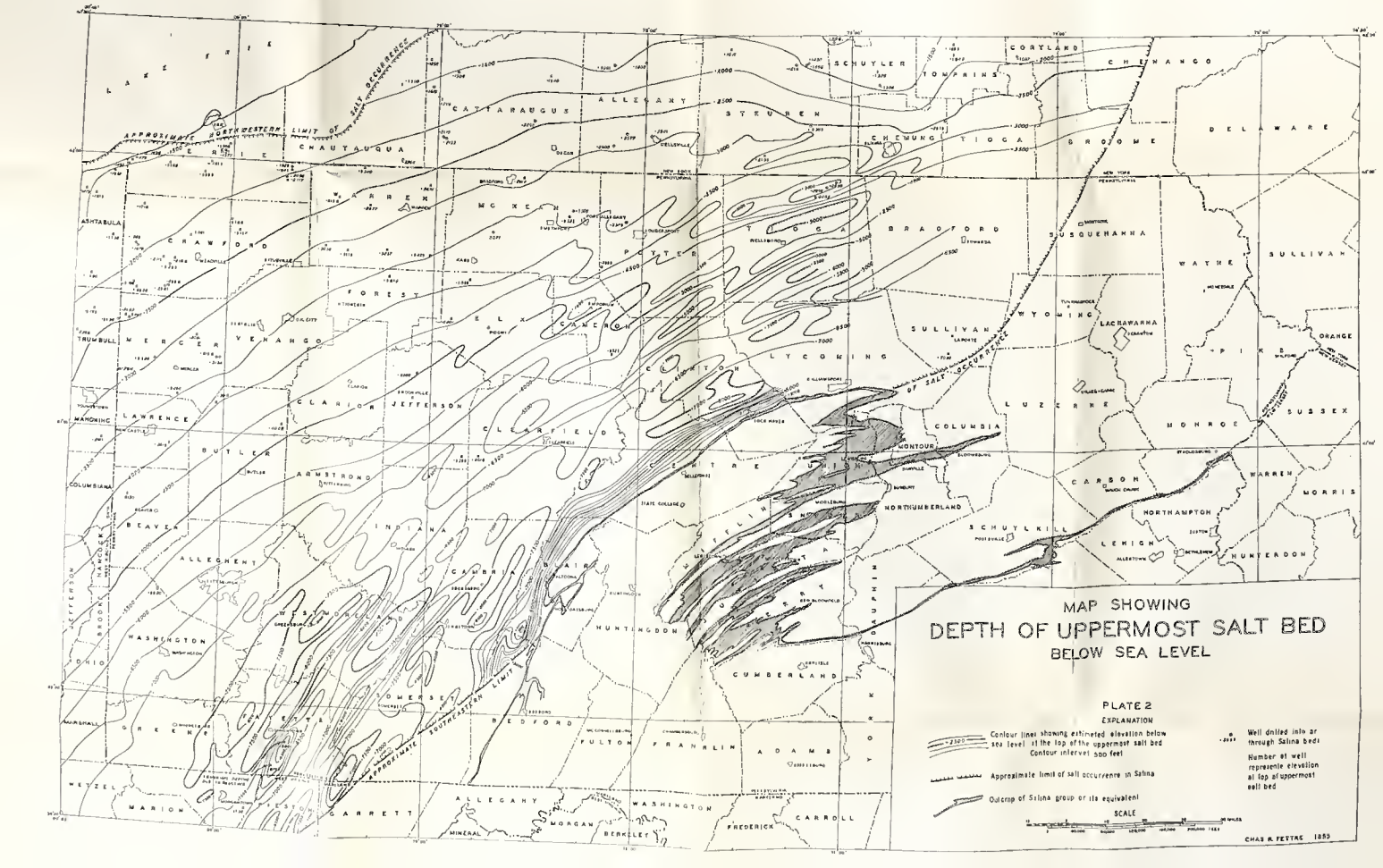
With very few exceptions, the wells drilled into and through the Salina group of rocks in Pennsylvania thus far have been drilled with cable tools. Unfortunately, it has not been the objective of any of them to test the salt beds. In numerous instances, however, samples have been taken of the drill cuttings each time the well was bailed, i.e., about every six to ten feet. Unless a saturated brine is used in drilling, much of the salt in the cuttings goes into solution in the drilling water. Salt is lost if the cuttings are washed with fresh water before the cut for examination is taken. There also is danger of contamination of the cuttings by caving from above in drilling rocks of the Salina type of lithology in an open hole. In addition to the tendency to go into solution in the drill water, salt cuttings may be so mixed with mud as to escape the notice of the driller when bailed from the well. In a section where salt is expected, the driller can usually detect the presence of the salt beds by the ease of drilling. Some drillers record individual salt beds while others record only the top of the uppermost and the bottom of the lowermost bed noticed. The intervening section may, and frequently does, contain much clay, shale, argillaceous dolomite and limestone, and anhydrite, besides salt. Although an estimate of the thickness of the salt beds based on the study of drill cutting samples can be considered to be only a rough approximation, it is usually much more accurate than that obtained from a driller's log. It is believed that the data shown on Plate 1 are sufficiently accurate to indicate where salt beds will probably be found, but confirmatory core tests should be made before exploitation.

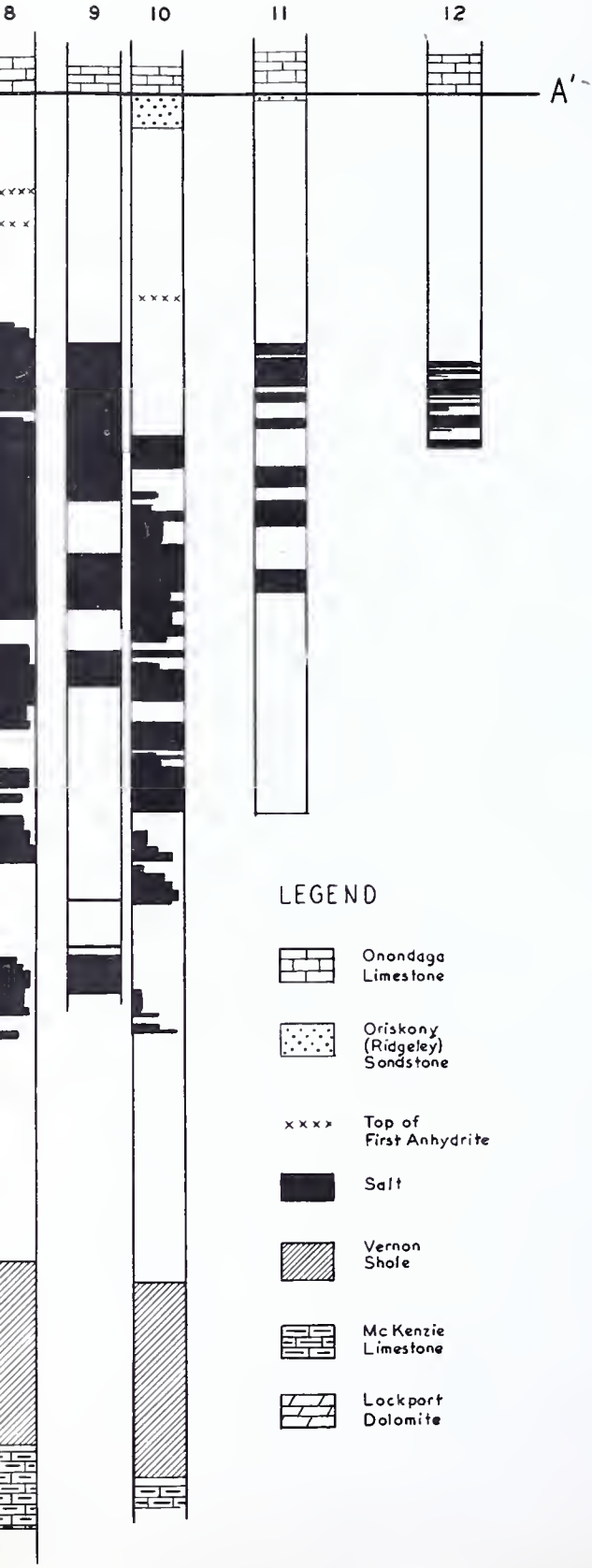
The interval between the top of the Oriskany sandstone, a readily identifiable geological horizon in the subsurface in north-central and western Pennsylvania, and the top of the uppermost salt bed ranges in thickness from about 250 feet in parts of northwestern Pennsylvania to 650 feet along the southeastern margin of salt occurrence. An isopach map was constructed for this interval. The depths of the uppermost salt bed shown in Plate 2 were obtained by projection from an Oriskany structure-contour map (Fettke, 1954, Plate 3) using the isopach map. The uppermost salt bed is not a single continuous layer of salt over the entire area as shown by Figure 1 in which the columnar sections obtained in the wells have been lined up with respect to the top of the Oriskany formation. The stratigraphic position of the salt in the Salina group varies from locality to locality. Also, faults are known to be present at the Oriskany horizon and undoubtedly intersect the Salina beds, but have been omitted on account of lack of sufficient data to project them to the deeper beds. The map, Plate 2, therefore, is not a true structure map. It is believed to be sufficiently accurate, however, to permit a rough approximation of the depth at which the first salt bed can be expected at any particular locality. This can be done by adding the local elevation above sea-level to the depth below sea-level of the salt estimated from the map. The greatest discrepancies will be found under the complexly folded domes, as, for example, the Summit dome along the Chestnut Ridge anticline in southern Fayette County. (See Fettke, 1954, Plate 3, Southwest Sheet).

The best development of salt in the plateau region of Pennsylvania appears to be in Potter, Tioga, and Bradford counties. The greatest total thickness encountered to date is in the Lyle E. Shoemaker No. 1 well, (No. 7, Plate 1 and Figure 1) in the northeastern corner of Tioga County. The total thickness in this well is 855 feet, 195 feet of which probably represents repetition due to faulting, leaving a net thickness of 660 feet. The second most important area, from the standpoint of total thickness, embraces southwestern Crawford and western Mercer and Lawrence counties.

Salt has not been reported on the outcrop of the Salina series or its equivalent where these rocks first come to the surface from underneath the Allegheny plateau in central Pennsylvania. The reason undoubtedly is that under the humid climate prevailing in this area, ground waters dissolve the salt a considerable distance down dip from the outcrop. On Plate 1, the southeastern limit of salt occurrence is shown as reaching the outcrop between Hollidaysburg and Williamsport in central Pennsylvania. In the Cormas well, No. 37, one mile northwest of the outcrop, considerable coarse crystalline salt was encountered associated with a reddish-grey shale of Bloomsburg lithology at a depth of 3,740 to 3,800 feet. Unfortunately, a complete set of drill cutting samples from this well was not taken.


APPROXIMATE NORTHWESTERN LIMIT OF SALT OCCURRENCE
APPROXIMATE SOUTHEASTERN LIMIT OF SALT OCCURRENCE
LAKE ERIE
CHAUTAUQUA
CATTARAUGUS
ALLEGANY
STEUBEN
SCHUYLER
TOMPKINS
CORTLAND
CHENANGO
CHEMUNG
TIOGA
BROOME
DELAWARE
BRADFORD
SUSQUEHANNA
WAYNE
SULLIVAN
WYOMING
LACKAWANNA
ORANGE
PIKE
SUSSEX
MONROE
LUZERNE
COLUMBIA
MONTOUR
NORTHUMBERLAND
SCHUYLKILL
NORTHAMPTON
CARBON
WARREN
MORRIS
POTTER
MC KEAN
WARREN
CRAWFORD
ASHTABULA
ERIE
FOREST
ELK
CAMERON
VENANGO
MERCER
TRUMBULL
CLARION
JEFFERSON
CLEARFIELD
CLINTON
LYCOMING
CENTRE
SNYDER
UNION
MIFFLIN
JUNIATA
PERRY
BUTLER
ARMSTRONG
INDIANA
LAWRENCE
MAHONING
COLUMBIANA
BEAVER
ALLEGHENY
WASHINGTON
GREENE
FAYETTE
WESTMORELAND
CAMBRIA
BLAIR
HUNTINGDON
SOMERSET
BEDFORD
FULTON
FRANKLIN
ADAMS
CUMBERLAND
YORK
OHIO
BROOKE
HANCOCK
JEFFERSON
MARSHALL
WETZEL
MARION
MONONGALIA
PRESTON
TAYLOR
BARBOUR
RANDOLPH
TUCKER
GARRETT
ALLEGANY
WASHINGTON
MORGAN
BERKELEY
MINERAL
FREDERICK
CARROLL
MAP SHOWING
COMBINED THICKNESS OF SALT BEDS
IN SALINA GROUP IN PENNSYLVANIA
PLATE 1
EXPLANATION
Isopach lines showing combined thickness of salt beds in feet, interval 50 feet
Broken lines based on limited data
Approximate limit of salt occurrence in Salina
Outcrop of Salina group or its equivalent
Wells used as control points
From well-sample record
From drillers log
Upper number at well represents combined thickness in feet of salt beds
Lower number represents thickness of thickest salt bed
SCALE
CHAS. R. FETTKE 1953


APPROXIMATE NORTHWESTERN LIMIT OF SALT OCCURRENCE
APPROXIMATE SOUTHEASTERN LIMIT OF SALT OCCURRENCE
LAKE ERIE
CHAUTAUQUA
CATTARAUGUS
ALLEGANY
STEUBEN
SCHUYLER
TOMPKINS
CORTLAND
CHENANGO
CHEMUNG
TIOGA
BROOME
DELAWARE
BRADFORD
SUSQUEHANNA
WAYNE
SULLIVAN
WYOMING
LACKAWANNA
ORANGE
PIKE
SUSSEX
MONROE
LUZERNE
COLUMBIA
MONTOUR
NORTHUMBERLAND
SCHUYLKILL
NORTHAMPTON
CARBON
WARREN
MORRIS
LEHIGH
HUNTERDON
POTTER
MC KEAN
WARREN
CRAWFORD
ASHTABULA
ERIE
FOREST
ELK
CAMERON
VENANGO
MERCER
TRUMBULL
CLARION
JEFFERSON
CLEARFIELD
CLINTON
LYCOMING
CENTRE
SNYDER
UNION
MIFFLIN
JUNIATA
PERRY
BUTLER
ARMSTRONG
INDIANA
LAWRENCE
MAHONING
COLUMBIANA
BEAVER
ALLEGHENY
WASHINGTON
GREENE
FAYETTE
WESTMORELAND
CAMBRIA
BLAIR
HUNTINGDON
SOMERSET
BEDFORD
FULTON
FRANKLIN
ADAMS
CUMBERLAND
YORK
OHIO
BROOKE
HANCOCK
JEFFERSON
MARSHALL
WETZEL
MARION
MONONGALIA
PRESTON
TAYLOR
BARBOUR
RANDOLPH
TUCKER
GARRETT
ALLEGANY
WASHINGTON
MORGAN
BERKELEY
MINERAL
FREDERICK
CARROLL
MAP SHOWING
DEPTH OF UPPERMOST SALT BED
BELOW SEA LEVEL
PLATE 2
EXPLANATION
Contour lines showing estimated elevation below sea level at the top of the uppermost salt bed
Contour interval 500 feet
Approximate limit of salt occurrence in Salina
Outcrop of Salina group or its equivalent
Well drilled into or through Salina beds
Number at well represents elevation at top of uppermost salt bed
SCALE
CHAS. R. FETTKE 1953


8
9
10
11
12
A'
LEGEND
Onondaga Limestone
Oriskony (Ridgeley) Sandstone
Top of First Anhydrite
Salt
Vernon Shale
Mc Kenzie Limestone
Lockport Dolomite
0
100 per cent